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CONICHALCITE FROM THE BRISTOL MINE, LINCOLN COUNTY, NEVADA*

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ABSTRACT

A fibrous mineral which was shown by quantitative chemical analysis to be identical with conichalcite was found on the dump of a small prospect on the property of the Bristol Silver Mine, Lincoln County, Nevada. Among the specimens collected was one small piece on which occurred a very small quantity of larger crystals. These yielded interference figures giving an optically negative sign. Conichalcite is given as optically positive. The indices of refraction are lower than those given by several varieties of conichalcite. Since the optical sign of the typical fibrous conichalcite is very difficult to determine, it is possible that conichalcite is in reality negative. If not, this mineral from the Bristol Mine is a new species.

OCCURRENCE

The crystals were collected on the dump of the "Inman" prospect on the property of the Bristol Silver Mines Company, Lincoln County, Nevada. The prospect is an opening on one of the locally called "Tempest" fissures at an elevation of about 7500 feet, on the west slope of the Bristol Range about one quarter of a mile east of the collar of the Snyder shaft of the Bristol mine. The position may be found on the Bristol Range, Nevada, topographic sheet of the U. S. Geological Survey at a latitude of about 38° 4′ 42″ and longitude of about 114° 36′ 57″.

The specimens were collected in the summer of 1924, during the field study of the Pioche, Nevada district, by Messrs. Westgate and Gillson, of the U. S. Geological Survey.

The ore in the Tempest fissures is an oxidized copper lead ore in which the most conspicuous minerals are jarosite, malachite, chrysocolla and copper pitch (melanochalcite). Although the ore in the Inman prospect is very similar to the ore in the Tempest fissures in the Bristol mine itself, and in other openings on the fissures, none of the arsenate mineral was found elsewhere.

PHYSICAL PROPERTIES

The arsenate mineral occurring on all but one unique specimen consisted of the typically green crustiform aggregates of very

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OPTICAL CONSTANTS OF CONICHALCITE FROM VARIOUS LOCALITIES

Analyzed fibers. Bristol Mine, Nevada	Larger crystals. Bristol Mine, Nev., unanalyzed	American Eagle Mine, Tintic District[1]	Locality Unknown[2]	Tintic District[3]	Simon Mine, Mineral Co., Nevada[4]	Good Springs, Nevada[5]
$\gamma=1.770\pm.003$ $\alpha=1.730\pm.003$ Variable in different crusts	$\gamma=1.771\pm.003$ $\alpha=1.730\pm.003$	$\gamma=1.801\pm.003$ $\alpha=1.778\pm.003$ Indices differ in different crusts	$\gamma=1.790\pm.005$ $\alpha=1.765\pm.005$ Indices differ in different crusts	$\gamma=1.790\pm.005$ $\alpha=1.765\pm.005$	$\gamma=1.810\pm.005$ $\alpha=1.790\pm.005$	$\gamma=1.795\pm.003$ $\alpha=1.770\pm.005$ Variable in different crusts
	2V about 25 degrees	Nearly or quite uniaxial	2V very small			
Optically?	Optically negative	Optically positive	Optically positive	Optically?	Optically?	Optically?
	Dispersion very strong $\rho>\nu$	No dispersion noticed				
α=yellowish to colorless γ=pale bluish green	α=yellowish to colorless β=pale greenish γ=pale bluish green	Pale green and not pleochroic		Pale green and not pleochroic	Pale green and not pleochroic	Pale green and not pleochroic
Parallel extinction	Parallel extinction	Parallel extinction	Parallel extinction	Parallel extinction	Parallel extinction	Parallel extinction
Positive elongation	Positive elongation	Positive elongation	Positive elongation	Positive elongation	Positive elongation	Positive elongation
Gravity 3.9[6]		Gravity 4.15				

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[1] Larsen, E. S. Microscopic determination of the non-opaque minerals: *U.S.G.S. Bull.* **679**, p. 60.

[2] Larsen, E. S. *Loc. cit.*, page 60.

[3] Determined by the writer on a specimen loaned from Harvard Univ., no catalog number.

[4] Determined by the writer on a specimen loaned from Harvard Univ., their catalog no. 86387.

[5] Determined by the writer on a specimen furnished by R. M. Wilke, Palo Alto, Calif.

[6] Determined by floating in Clerici's solution.

minute fibers very similar to the conichalcite from the American Eagle Mine, Tintic district, Utah. On such material the maximum and minimum indices of refraction are the only optical constants readily obtainable. Since these indices were appreciably lower than those recorded for conichalcite in standard mineralogy references, the identity of the fibers was in doubt until the quantitative analysis was made by Mr. E. V. Shannon of the U. S. National Museum.

The one unique specimen consisted mainly of yellowish jarosite, and contained aggregates of green crystals, individuals of which were sufficiently large to yield optical interference figures. Although these crystalline aggregates were mixtures of three minerals, the one that agreed in indices of refraction and pleochroism with the fibers of the other specimens was shown by repeated microchemical analysis to contain lime, copper and arsenic, the constituents of conichalcite.

The optical constants were determined as follows, and they are compared with those of several varieties of conichalcite.

THE CHEMICAL COMPOSITION

The fibrous conichalcite of usual habit was analyzed by Mr. E. V. Shannon of the U. S. National Museum. The mineral was very intimately mixed with "copper pitch" and all attempts to separate the two minerals by means of heavy solutions and with the electromagnet failed. Accordingly, the material for analysis was handpicked as carefully as possible under the binocular microscope and about three-tenths of a gram was so obtained in which probably about 10 per cent of "copper pitch" remained. The analysis by Mr. Shannon is as follows:

ANALYSIS OF CONICHALCITE FROM THE BRISTOL MINE, NEVADA,

CaO	18.34
CuO	29.23
As_2O_5	38.11
Al_2O_3	0.85
Fe_2O_3	0.20
H_2O above 110°	6.45
H_2O below 110°	0.99
SiO_2	1.32
MnO_2	1.28
CO_2	1.95
	98.72

The mineral was proven free of nitrates, chlorides and sulphates. The "copper pitch" was shown by qualitative analysis to contain a considerable quantity of copper, manganese, iron, alumina, silica, carbon dioxide, and water. Hence all of these oxides, foreign to conichalcite, can probably safely be considered as impurities in the analysis. The composition of "copper pitch" (melanochalcite) is, as Hunt and Kraus,[1] and Rogers[2] have shown, very uncertain. However, considering about 10 per cent of the "copper pitch" to have been present in the analyzed material, and considering that the amounts of alumina, ferric oxide, manganese oxide, carbon dioxide and silica shown in the analysis belong with the "copper pitch," an analysis of that mineral may be assumed, and these quantities deducted from the total analysis of the conichalcite. This analysis can then be recalculated to 100 per cent.

ESTIMATE OF IMPURITIES IN THE ANALYZED CONICHALCITE

CuO	3.00
MnO_2	1.28
SiO_2	1.32
Al_2O_3	0.85
Fe_2O_3	0.20
CO_2	1.95
H_2O	2.00
	10.60

Recalculating the conichalcite analysis on this basis gave the following values which are compared with the interpretation of the analyses given by Dana.[3]

	Recalculation of analysis of conichalcite from the Bristol Mine with impurities eliminated.	Recalculation of analysis of conichalcite given by Dana.
CaO	21.4	21.2
CuO	30.0	30.1
As_2O_5	43.6	43.6
H_2O	5.0	5.1
	100.0	100.0

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[1] Hunt, W. F., and Kraus, E. H. Note on the variable composition of melanochalcite: *Amer. Jour. Sci.*, (4) **41**, pp. 211–214 (1916).

[2] Rogers, A. F., A review of the amorphous minerals: *J. Geology*, **25**, 527–8, (1917).

[3] Dana, E. S. A system of mineralogy: 6th Edition, p. 836, 1892.

These figures indicate identical ratios in the two analyses. The molecular ratios are as follows:

$$\begin{aligned} CaO &= .382 = .191 \times 2 \\ CuO &= .378 = .189 \times 2 \\ As_2O_5 &= .181 = .181 \times 1 \\ H_2O &= .240 = .180 \times 1\tfrac{1}{2} \end{aligned}$$

Conichalcite seems to be definitely a double salt, for the copper oxide and the lime do not vary reciprocally and are not isomorphous. It, therefore, seems to the writer that the formula should be written: $2CuO.2CaO.As_2O_5.1\frac{1}{2}H_2O$, instead of $4(Cu,Ca)O.As_2O_5.1\frac{1}{2}H_2O$.

The larger crystals on which interference figures were obtained and which gave a negative optic sign were not analyzed quantitatively. The amount available was much too small and the crystals were so mixed with two other green minerals that only very minute grains could be separated. These other two minerals were identified in order to make certain that the qualitative tests for lime and arsenic were not being given by them. One is certainly brochantite, the other very probably langite, $4CuO.SO_3.H_2O$. Of course, a confirmatory test for sulphate on the latter was not diagnostic in the presence of brochantite. The absence of phosphate served to eliminate libethenite, a mineral with similar properties.

Repeated qualitative analyses were made on the arsenate crystals examined optically by drying off the immersion medium used in the identification of the material, and by then dissolving the fragments on the glass slide in a drop of nitric acid. Ammonium molybdate solution was added and the solution boiled, previously noting that no precipitate formed in the cold liquid. Upon boiling a yellow precipitate indicated a test for arsenic. A test for calcium was made with ammonium oxalate solution separately when sufficient material was available for making two fractions, or in the same solution by adding ammonium hydroxide which dissolved the yellow precipitate of ammonium arseno-molybdate.

These qualitative tests on material of the same indices of refraction and pleochroism as the analyzed fibers seem to indicate with reasonable certainty that the larger crystals and the analyzed fibers collected from the same place are varieties of the same mineral.

Discussion of the Results

The chemical analysis shows that the fibrous material is identical with conichalcite in composition. The lower indices of refraction, and the pleochroism, throw some doubt, however, on its being the same species.

The larger crystals are optically negative, conichalcite has been determined as positive. Professor E. S. Larsen, who determined the optical constants on two varieties of conichalcite says[4] that the interference figure with positive sign that he obtained may have been caused by a spherical aggregation of fibers of positive elongation and may not have been true figures. The writer attempted to obtain interference figures from the minute fibers so characteristic of the material from the Simon Mine, Nevada, and from the Tintic district, Utah, but without success. The spherical aggregates do, however, give a figure resembling a uniaxial cross, which appears optically positive.

These results indicate, therefore, either that the optical character of conichalcite has been incorrectly given as positive, or they indicate that another mineral similar to conichalcite exists, hitherto unknown. In order to settle the question it seems necessary to wait the discovery of other crystals of conichalcite large enough to yield satisfactory interference figures.

The writer wishes to thank Mr. E. V. Shannon for making the analysis, Professor E. S. Larsen for assistance in checking over the optical determinations, and Professor Charles Palache for the loan of the specimens of conichalcite from the Harvard Mineralogical collection.

[4] Larsen, E. S. Personal communication.

SOME METHODS FOR DETERMINING REFRACTIVE INDICES

A. N. Winchell and R. C. Emmons, *University of Wisconsin*

The ordinary immersion method of determining index of refraction consists in comparing the index of a mineral with those of a series of liquids with the final result that the index of the mineral is equal to that of one of the series of liquids or lies between those of two consecutive liquids. Whenever a sufficient amount of pure material is available the method is easily used and rather rapid, but whenever an unknown mineral is available in only small amounts, or intimately mixed with other minerals not easily distinguished from it under the microscope, the method is difficult, if not impossible, to use because it is so hard to handle a microscopic particle in order to free it from one immersion liquid and immerse it in another.

Merwin[1] has improved the accuracy of the immersion method by using a prismatic monochromator with which it is possible to vary at will the kind of light used; since the indices of refraction of liquids do not vary at the same rate as those of solids it is always possible to find conditions such that the index of the mineral is equal to that of the liquid; this makes it unnecessary to be content with a determination that the index of the mineral is between those of two consecutive liquids. This does not, however, obviate the difficulty of applying the method to small amounts of material since it is still necessary to use more than one liquid for the determination of each index.

It is the purpose of this article to describe a procedure by means of which the number of liquids which must be used is considerably reduced under unfavorable circumstances, while a single liquid is sufficient, if the unknown index of refraction can be estimated approximately beforehand. This procedure requires the use of two methods to vary the index of the liquid, one of these being the same as the method of Merwin and the other being change of temperature. Varying the index of the liquid by changing the temperature is particularly useful, because the change of temperature produces only a negligible effect upon the index of the

[1] E. Posnjak and H. E. Merwin: *Jour. Am. Chem. Soc.*, **XLIV**, 1970, (1922). See also: S. Tsuboi: *Jour. Geol. Soc. Tokyo*: **XXXII**, No. 377, (1925).

mineral[2] whereas change of wave-length produces an important effect upon the index of the mineral.

The net result of this double method of varying the index of the liquid is that under favorable circumstances it is possible to determine accurately *all* the indices for sodium light of a single mineral grain (by turning it into various positions, if necessary) while immersed in a *single* liquid.

The procedure is simple. A grain is mounted on a slide in which the temperature is known. Each index is read at two temperatures and at two wave-lengths and all four values are recorded. This is equivalent to measuring each index in two immersion media and at two wave-lengths of light.

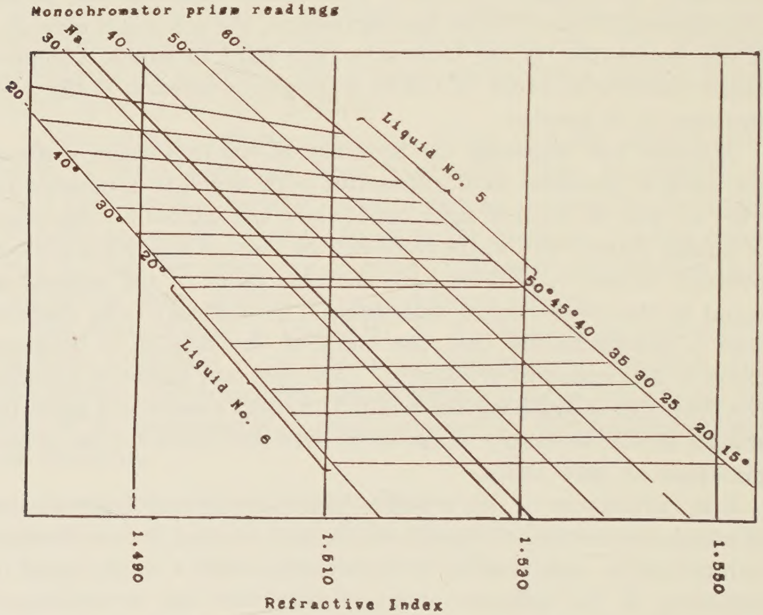

Fig. 1. Temperature Dispersion Diagram

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[2] Changes of index of refraction for 1°C in units of the 5th decimal place, *D* line. (Taken from Landoldt-Bornstein Tabellen.)

Fluorite		1.11	Quartz	ω	.59
Halite (exceptionally high)		3.70		ε	.70
Sylvite		3.46	"Amorphous Quartz"		1.02
Calcite	ω	.07			
	ε	1.10			

On Merwin's diagram (Fig. 1) each liquid is plotted to show its dispersion. To this must be added sufficient data—in the form of the few extra lines shown on the diagram—to indicate the dispersion of each liquid through the temperature range possible on the instruments. The diagram is then used in a manner similar to that originally devised by Merwin, regarding the lines representing the dispersion of the liquids at different temperatures as equivalent to lines representing the dispersion of different liquids at room temperatures.

By the use of this method, the number of liquids required to cover the range of refractive indices of common minerals is very much reduced, which means that the number of mounts that it is necessary to make is reduced and much time is saved. In studying soils, heavy residues, etc., many mounts may be examined before the desired mineral is found. It is then a very real satisfaction to be able to determine the constants of the grain and not to have to remount and search for it again.

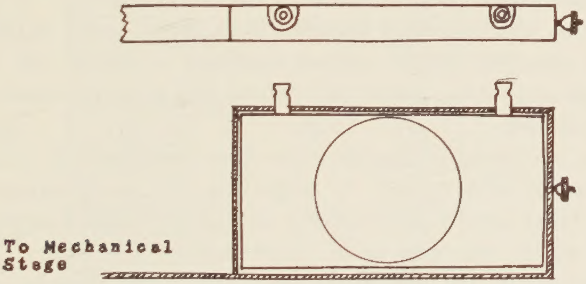

Fig. 2. Water Circulation Cell

To obtain monochromatic light we use a small Leitz monochromator. This instrument does not give as limited a range of wavelengths as a larger instrument but it can be so adjusted when a final reading is to be made that the range is only a few $\mu\mu$ in the red and is essentially monochromatic in the violet. On the whole is has been found quite satisfactory for this purpose.

Refractive indices of liquids are read on a Spencer-Abbé refractometer which is on the same temperature control system as the microscope and which uses the same light as the microscope. When an immersion medium is changed on the microscope stage it is also changed on the refractometer. A simple curve supplied by the manufacturer of the Abbé refractometer makes it adaptable to use with monochromatic light.

The object glass used was constructed for the purpose. It consists of a small rectangular metallic cell equipped with two tubes—one for intake and the other for the outlet of circulating water, as shown in Fig. 2. On the lower side of the center of the cell is a glass plate of the thickness of ordinary object glasses. Directly above this is a round cover glass fixed in the upper side of the cell. The circulating water flows between these glass plates. The mount is placed directly on the cover glass and is covered by a quarter-size cover glass. The purpose of the cover glass on the upper side of the cell is to place as little insulation as possible between the circulating water and the mount. The cell is mounted on a mechanical stage but this is not necessary.

A pump serves to circulate the water. The water passes a thermometer, through the cell on the microscope, through the refractometer and by another thermometer. When the thermometer readings check the temperature of the system is assumed to be uniform. The temperature is not raised above 50°C because high temperatures are injurious to the refractometer. A range of 40° is then available and this has been found quite satisfactory. A small reservoir in the system contains a copper coil through which hot or cold tap water circulates—this gives excellent control of temperature.

About one hundred liquids have been examined to obtain the best possible with respect to dispersion and temperature coefficients. More are to be examined before final selection of liquids will be made; we offer none, therefore, at this time. Further modifications of the apparatus are being attempted in order to include the higher refractive indices, thereby overcoming the limitations imposed by the Abbé refractometer.

NOTES ON HORNBLENDE

W. A. P. Graham, *University of Minnesota*

Variations in the Chemical Composition of Hornblende from Different Types of Igneous Rocks

Certain petrographers have assumed[1] that the hornblendes from any given type of igneous rock have approximately uniform composition and have utilized this assumption in estimating the chemical composition of rocks. With a view of investigating the truth of this hypothesis a study of seventy-five or more analyses of hornblende[2] from different rocks, occurring the world over, was made. It was found that the composition of hornblende in any family of rocks varied widely. The assumption that they are uniform is not warranted. In some analyses the elements which are usually present in only small amounts in the hornblende are found to vary even more than some of the main constituents; for example, MnO is reported to be 16% in one analysis of hornblende while it is absent in others.

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[1] Iddings, I. P.; Rock Minerals, pp. 350–354 (1911).

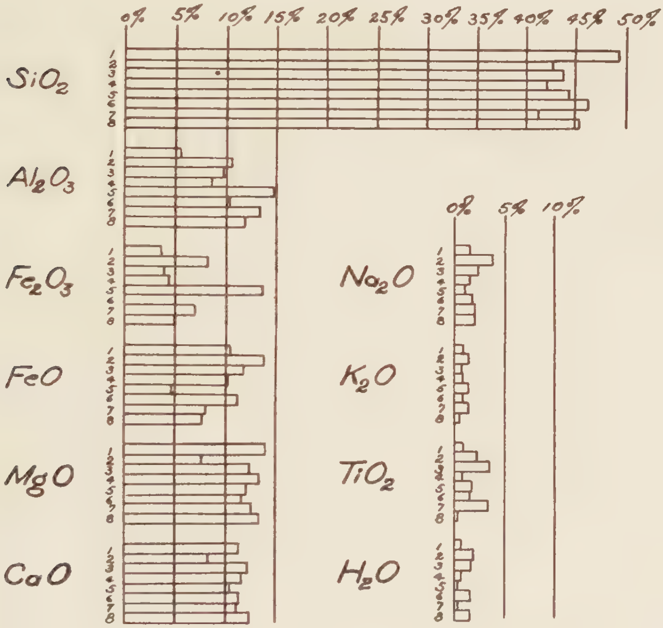

FIG. 1. Average of Each Constituent in the Hornblendes of the Several Rock Families.

1. Granite
2. Syenite
3. Monzonite
4. Granodiorite
5. Andesite
6. Diorite
7. Basalt
8. Gabbro

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[2] Doelter; Handbuch der Mineralchemie, Band II, pp. 610–628 (**1914**). Osann, A.; Beiträge zur chemischen Petrographie, Teil 2, pp. 247–250 (**1905**). Clarke, F. W.; *U.S.G.S., Bull.* **168,** p. 131. Penfield, S. L.; *Am. Jour. Sci.*, (4) **XXIII,** p. 23 (1907). Stanley, F. C.; *Am. Jour. Sci.*, (4) **XXIII,** p. 23 (1907).

The analyses of hornblende that occur in the several rock families were grouped together and averaged. Following are the number of hornblende analyses used in determining the averages of each rock type; granite 6, syenite 10, monzonite 5, granodiorite 4, andesite 5, diorite 8, basalt 5, gabbro 10. (See Fig. 1.) It seems clear that the optical properties such as those discussed by Winchell[3] are more accurate indications of the composition of the hornblendes than the type of rock in which they are found.

RELATION OF BROWN TO GREEN HORNBLENDE

A study of the optical properties of the amphiboles has been made by Winchell.[4] He states that it has not been found possible to include in his work the so-called basaltic hornblendes; that is, those characterized by small extinction angles, high relief, brown color, and strong birefringence; due to lack of chemical data on the factors producing these properties. He suggests that the differences between the brown and green hornblendes are due to titanium, occurring as TiO_2 and Ti_2O_3.

Schneider[5] states that there is nearly 5% titanium oxide in the balsatic hornblendes but this is not borne out in the present study.

Weinschenk[6] says that the basaltic varieties of hornblende owe their brown color to the presence of ferric oxide and that they contain up to 5% titanium. He also notes that all green amphiboles assume a brown color when heated in air and those rich in iron, after heating, have the optical properties of basaltic hornblende.

A. Belovsky[7] heated green hornblende for an hour over a bunsen flame and found that he was able to change the color from green to brown and lower the extinction angle. He attributes this change to the oxidation of the iron.

Allen and Clement[8] suggest that the loss of water by amphiboles on heating without notably affecting the optical properties indicates that the water is present as a solid solution although the mineral holds the water with great tenacity.

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[3] Winchell, A. N. Studies in the Amphibole Group, *Am. Jour. Sci.*, **7**, 5th Series, pp. 287–310, April, **1924**.

[4] Winchell, A. N., *op. cit.*

[5] Schneider; *Z. Kryst.*, **XVIII**, 580 (1890).

[6] Weinschenk, Ernst; Petrographic Methods, pp. 291–292 (**1912**).

[7] Belovsky, A.; *Neues Jahrb. Min.*, **1**, p. 291 (1891).

[8] Allen, E. T. and Clement, J. K.; Rôle of Water in Tremolite. *Am. Jour. Sci.*, **26**, p. 118 (1908).

J. deLapparent[9] suggests that the optical differences developed in the change from green to brown hornblende are due to the loss of water which is present as a solid solution in the green variety.

Average of the Main Constituents in Green and Brown Hornblende from Analyses Studied

	Brown	Green		Brown	Green
SiO_2	39.42%	46.42%	CaO	10.25%	10.56%
Al_2O_3	15.43	7.57	MgO	11.90	11.46
Fe_2O_3	7.07	4.20	Alkalies	1.91	1.32
FeO	8.21	11.91	TiO_2	2.52	0.90
			H_2O	0.46	1.58

Many of the published analyses of hornblende do not report the water content, but it is quite evident that the brown basaltic varieties have less water than the green ones. The average combined water in six good analyses[10] of the brown variety is 0.46%, while that in 19 analyses of the green variety is 1.58%.

A study of the occurrences of hornblende show that the brown hornblendes are usually found in the fine grained surficial igneous rocks such as basalts, dacites, andesites, etc., as Clarke has noted,[11] while the green varieties usually occur in the granitoid igneous rocks. It is not improbable that some hornblende may be brown because of other constituents, such as alumina, ferric oxide, or titanium.

This occurrence of most brown hornblendes in surface rocks which could have been dehydrated, in connection with the contrast in water shown in the analyses, suggests that deLapparent may have been correct in attributing the change from green to brown hornblende to the loss of water.[12] The difference in the state of oxidation of iron seems relatively unimportant and the titanium content is rarely as large as suggested by Schneider.[13]

Experiments were undertaken in elaboration of the suggestions of Belovsky and deLapparent. Large crystals of green hornblende were crushed to pass through a 100-mesh screen. Some of the impurities were picked out during the preparation. A small portion of each hornblende was weighed into a platinum crucible and weighed again after heating to about 800°C to determine the amount of water lost. A CO_2 blanket was kept over the hornblende during the heating to prevent oxidation by air.[14] The heated samples were examined in oils for any changes in optical properties. Figure 2 shows the results obtained from two samples with heats of different durations.

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[9] deLapparent, J.; Leçons de Petrography, pp. 50–53 (1923).

[10] Two old analyses of poor quality were discarded. Their water content was high and if included would raise the average combined water to 0.89%.

[11] Clarke, F. W., Data of Geochemistry, *U.S.G.S. Bull.* **770**, p. 389 (1924).

[12] deLapparent, J., *op. cit.*

[13] Schneider, *op. cit.*

It is clear that a brown color is developed in green hornblende through the loss of water as was indicated by the analyses studied. There is a progressive decrease in the water content produced by heating and this seems to be complete after ten minutes heating. This change is accompanied by a lowering of the extinction angle, increasing birefringence, increasing index of refraction, and the brown color, which are all characteristics of basaltic hornblende. (See figure 2.) These experiments strongly suggest that the water is the controlling constituent.

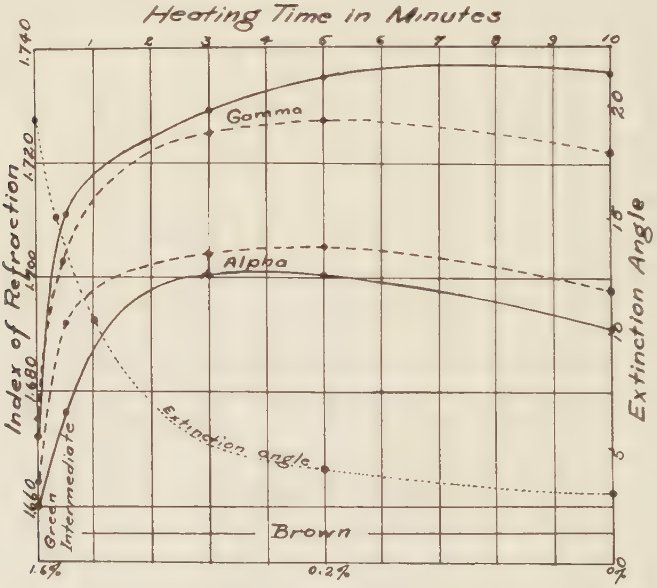

FIG. 2. Optical Changes Produced by Heating Common Green Hornblende.
Approximate Water Content
——— Index of Refraction Sample No. 1
- - - - Index of Refraction Sample No. 2
...... Approximate Extinction Angle

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[14] It is possible there may have been oxidation by water driven from the hornblende during heating, but this is a reaction of the original parts of the mineral and not an oxidation from atmospheric oxidation.

An x-ray picture was taken of one sample of hornblende before and after ten minutes heating. The diffraction angles of the heated sample are slightly greater than in the unheated one. This indicates that in the heated hornblende the planes of atomic structure are a trifle closer together and the mineral is slightly denser.

Finally, seven different samples of hornblende were tested by ten minutes heating and, while the results are not entirely regular, the hornblendes which had relatively high indices in their original green condition gave generally high indices and birefringence in their dehydrated modifications. (See figure 3.)

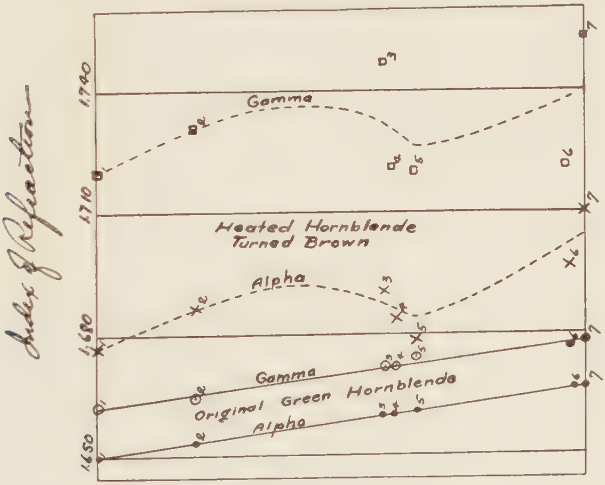

FIG. 3. Comparison of Indices of Common Hornblende before and After 10 Minutes Heating.

Spot = Alpha of Green Hornblende
Circle = Gamma of Green Hornblende
Cross = Alpha of Heated Hornblende, Brown
Square = Gamma of Heated Hornblende, Brown

The different indices of the original Green Hornblende are due to different chemical proportions of constituents.

APPLICATIONS OF COLLOID CHEMISTRY TO MINERALOGY*

PART I. PRELIMINARY REPORT

L. W. Fisher and F. L. Simons, *Brown University*

Introduction

This report deals with a study of the growth of crystals in colloidal media, their crystal forms, and the variations in these forms obtained under varying conditions. The crystals were prepared by Dr. F. L. Simons, of the Chemistry Department of Brown University.

The study of laboratory-grown crystals of substances of mineralogical interest has many obvious possibilities. The control, however, of any such laboratory preparations has always been difficult and uncertain in most cases. We have never been able to supply those conditions of pressure, temperature, acidity, rate of diffusion, etc., that prevail during the formation of crystals in nature.

The recent developments of colloid chemistry now offer us, in part at least, a new line of attack. Gels (of silicic acid, agar, gelatine, etc.) form excellent media for the growth of crystals of almost any substance under absolutely controllable conditions that approach perhaps more closely those of nature, except for temperature and pressure, than any other laboratory method. The results may very well be far-reaching. Earlier investigators have shown that gold or copper crystals may be prepared by reduction of the metal salts in silica gel. The connection between these experiments and the existence of gold-quartz veins is too striking to need further comment. Banding phenomena (rhythmic deposition of crystals or precipitates) which occur so frequently in gels, are undoubtedly the laboratory's answer to similar phenomena in nature.

Gels are not absolutely necessary to give us control of experimental conditions; any medium which will retard the mixing of the reagents which form the crystal will serve. H. N. Holmes has demonstrated that fine clay, powdered sulphur and even sawdust will serve. The chemist has already begun work in this field and the mineralogist should further its development.

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* Presented at the sixth annual meeting of The Mineralogical Society of America, New Haven, Conn., December 28, 1925.

There are no systematic data on the influence of inert substances, acidity and the concentration on the formation of crystals by slow diffusion as in gels. Presence of inert substances or acidity, etc., may give us the explanation of the different forms of polymorphous types. The authors have, therefore, elected to take this field as a starting point and for preliminary work three simple substances—lead iodide, mercuric iodide, and calcium carbonate—were studied as these were easy to prepare and there is available data on the first two. Silicic acid formed by the interaction of acetic acid and sodium silicate was used as the gel. The lead iodide was prepared by the interaction of lead acetate and sodium or potassium iodide, the mercuric iodide by interaction of potassium iodide and mercuric chloride, and the calcium carbonate by calcium acetate and sodium carbonate. One of the reagents was incorporated into the gel before setting and the second, in aqueous solution, floated on the hardened gel. Before going intensively into this subject it was felt desirable to gain some general knowledge of the difficulties involved and to develop a technique. This paper reports some of the preliminary work.

Procedure

A definite order of procedure was followed in making each specimen. 10 cc. of the sodium silicate solution were placed in a test tube first; the amount of acetic acid to be used, which varied with each experiment, was then placed in another tube. The reagent which was to be present in the finished gel was then added to the latter tube and thoroughly mixed with the acetic acid. The sodium silicate was then poured into the acetic acid and after mixing was set aside to gelatinize. After the gel had become firm (a matter of from one to six hours) the second reagent was floated on the surface, the amount usually being 10 cc.

Rate of Growth of Crystals

The rate of growth of the crystals varies directly with the concentration, acidity having little effect in the experiments tried thus far. This concentration effect was to be expected as the rate of diffusion of the two reagents is a function of the concentration. The crystals began to grow immediately after the gel had set, continuing until one of the reagents was exhausted. In general the crystal growth progresses down a six inch test tube at the rate of ¼ to ½ inch a day. Studies of the rate of growth are to be eventually included in the present research.

MERCURIC IODIDE

But two tubes of the mercuric iodide series were studied.

Tube A. 1 gm. KI in gel; saturated $HgCl_2$ floated on top.
Tube B. 0.15 gm. KI in gel; saturated $HgCl_2$ floated on top.
10 cc. of 1.062 sodium silicate; 10 cc. N. acetic acid.

In tube A six very distinct bands of red mercuric iodide were noted, the forms being ditetragonal pyramids and prisms. After the development of the last band, long, slender, prismatic crystals some 3 cm. in length were developed in the gel.

In tube B 24 distinct bands were noted, each succeeding band becoming smaller. The first six of these showed the same crystal forms as noted in A, but following the development of the last band no large crystals were formed.

In both these tubes a yellow iodide formed first. This was unstable and changed usually within 12 hours to the more stable red form. The transition temperature of these forms in aqueous solution is 127°C. Because of the rather slow transition in the gel it was possible to study these forms which are orthorhombic.

Holmes states in his Laboratory Manual of Colloid Chemistry (pp. 95–96) "The presence of glucose made the bands sharper. Sodium chloride diminishes the tendency to band and in sufficient concentration prevents banding altogether. If $Hg(NO_3)_2$ is floated on the gel instead of $HgCl_2$ still finer banding will result due to the fact that sodium chloride will not be present."

The unstable yellow mercuric iodide is not noted by Holmes in his discussion of the substance, and apparently we have found here a highly convenient method of preparing unstable crystal modifications of mercuric iodide and other substances. This observation opens a new field of possibilities.

LEAD IODIDE

Due to the large number of different types of crystals formed of lead iodide, interesting information regarding the effects of the acidity and concentration on the development of crystal forms was obtained. Lead iodide has been prepared by this method by a number of investigators but no systematic study of varying crystals forms has apparently been made.

Series A. N/1 lead acetate in gel; 50pc. KI floated on top. In this series the acidity was varied starting with 10 cc. of acid to 10 cc. of sodium silicate and dropping off 0.2 cc. of acetic acid for each tube.

Branching forms of lead iodide (Figure 1) develop predominantly with a fair showing of hexagonal plates. These branching forms show terminations of 60° and 120° and appear to be trigonal forms grouped with the *c* axes parallel. They are optically negative and have an index of refraction higher than Canada balsam. (Figure 2.) Some of the fibers are simple while others are quite complex and show divergent branches. In some of the tubes hexagonal plates were attached to the fibers. These plates for the most part showed a perfectly hexagonal central nucleus.

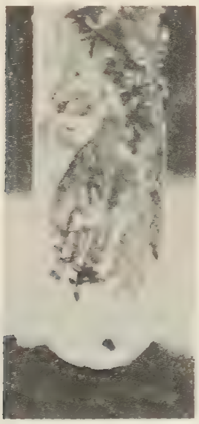

Fig. 1

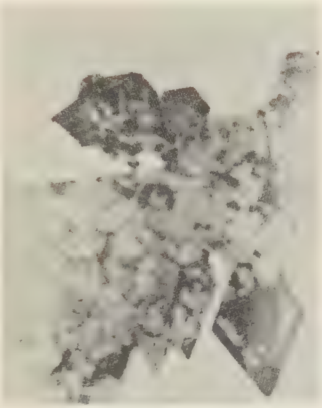

Fig. 2
×30

By varying the acidity (dropping from 10 cc. of acetic acid to 9.4 cc. of acid) the branching forms become less numerous and in the tube containing the latter acidity the best developed and the most numerous hexagonal plates are developed. As the acidity was further decreased the plates began to disappear. It appears, therefore, that the above acidity is the transition point between these two forms. When the acidity was dropped to 8.0 cc. there was a pronounced dimunition of the platy forms.

Series B. This series carried the decrease in acetic acid still further and when 7.6 cc. of acid were used the plates disappeared altogether. Sodium iodide was used instead of potassium iodide.

Series B_1. This series parallels B with the concentration of the lead acetate in the gel cut to 50 pc. There is a noticeable dropping off of platy forms and when 6.8 cc. to 6.4 cc. of acetic acid were used no plates developed. Rough hexagonal outlines are noted and the slide shows platy developments with a hexagonal nucleus about which are grouped roughly outlined hexagonal forms (Figure 3).

Series C. 1 cc. of 3N. solution of sodium iodide was incorporated in the gels of varying acidity and saturated lead acetate floated on top. The branching forms diminish considerably and when 7.0 cc. of acid were used there appeared no branching forms. This was the only tube in which none of these forms were present. The hexagonal plates reach their strongest development in this tube.

The procedure followed in series A, B and B_1 was to float KI on the gel. In series C where the iodide was placed in the gel matters were complicated by the presence of a double salt of varying composition (PbI_2–$Pb(Ac)_2$) along with the fibrous and platy forms discussed. These double salt crystals also appeared in A, B and B_1 but in relatively small numbers. While the double salt was purely incidental and not the main object of the study, the variations in its crystal forms were sufficiently interesting to warrant mention in this paper.

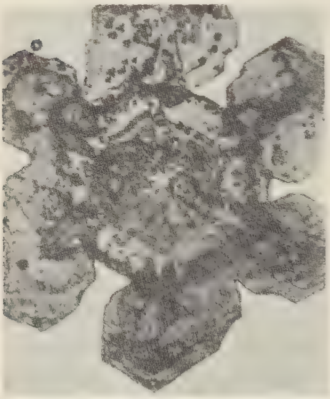

Fig. 3
×45

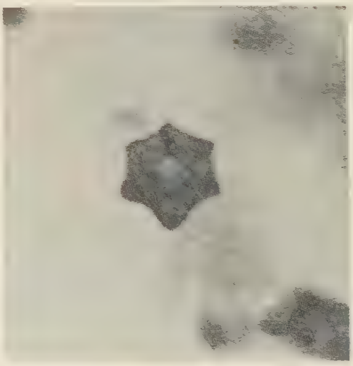

Fig. 4
×60

The first form of this double salt to appear was a snowflake crystal. These forms are pale yellow in color as contrasted with the orange color of the plates and fibers. When the acidity of the gel is kept the same and the concentration of the sodium iodide reduced 50 pc. numerous orthorhombic forms appear. Cruciform twins are quite abundant. As the alkaline end of each series is reached the double salt becomes more prominent and simple crystals are more numerous than cruciform twins.

The double salts formed due to the fact that the concentration of the reagent in the gel greatly exceeded the concentration of the reagent diffusing downward from above. The end members of series B and B_1 which differ in their concentration show radically different forms. The former were commonly combinations of domes and prisms of the orthorhombic system with a few pyramidal terminations. Some apparently hemimorphic forms were also noted. The end members of series B_1 showed peculiar prismatic stalk-like crystals with fibrous forms grouped about one or both ends. In some cases there was a radial grouping present. These forms resembled very strongly the stalk and petals of a flower.

The presence of inert salts, although not radically affecting the forms of the double salts, did produce some new types. In the presence of NH_4NO_3 which was incorporated in a gel of type of series A, domatic forms became less prominent and spherical groupings were noted. When the amount of ammonium nitrate was trebled but one cruciform twin was noted. KNO_3 added to a similar gel in small amounts seemed to have no effect upon the forms.

CALCIUM CARBONATE

The crystals were prepared by the usual general method using 0.5 cc. to 1.00 cc. N/1 calcium acetate in the gel and N/1 sodium carbonate floated on top. Experimental data on these forms are at present meagre. All specimens showed a multitude of very small rhombohedrons of calcium carbonate fairly well developed. In most of the tubes the rhombohedral forms of calcite were present with forms resembling pseudohexagonal twins of aragonite (Figure 4). Varying the acidity between rather wide limits seemed to have no effect on either the abundance or the type of crystals produced. Studies of the effect of varying concentrations have yet to be made. The presence of forms resembling aragonite in this series is a very important point for obvious reasons.

SUMMARY

1. This paper calls attention to the value of studies of laboratory grown crystals of substances of mineralogical interest providing

such laboratory conditions can be adequately controlled and can approach in some measure those found in nature.

2. The use of colloidal media such as silica gel is suggested as a method of obtaining such control.

3. The authors have undertaken a detailed study of the effect of acidity, presence of inert substances, concentration and diffusion phenomena on the formation of crystals.

4. Preliminary experiments with lead iodide, mercuric iodide and calcium carbonate, carried out to obtain a general idea of the difficulties involved and to develop an experimental technique, indicate the following: (a) Rate of crystal growth in the cases studied is not affected by the acidity of the medium. (b) Unstable polymorphous forms may be held in 'suspended transformation' long enough for convenient study. (c) Concentration and acidity have a very decided influence on crystal form. In some cases the two factors are interdependent. (d) Studies of calcium carbonate indicate that the conditions determining which crystal form a substance may take (i.e. calcite or aragonite) are within experimental reach.

BARYSILITE FROM FRANKLIN FURNACE, NEW JERSEY

E. V. Shannon, *U. S. National Museum*
AND
H. Berman, *Harvard University*

Barysilite, a lead silicate hitherto known only from Långban and Pajsberg, has recently been identified at Franklin Furnace. It was found on the picking table in a few small masses and its chemical character was first recognized by members of the staff of the chemical laboratory of the New Jersey Zinc Company. Material was sent by them to the Harvard Mineralogical Laboratory, together with a preliminary analysis. It was at first thought to be alamosite but its true nature appeared when the analysis given below had been made on purer material.

The barysilite occurs, in the single specimen examined, as a massive, pink to colorless mineral, associated with yellow garnet and colorless willemite. There are, however, occasional druses of minute pink crystals of the mineral, too small for crystallographic measurement. The habit is strikingly different from the Swedish occurrences of barysilite in that the grains seem to be equidimensional rather than curved lamellar.

The separation of barysilite was made by Berman with the aid of Clerici[1] solution. Some remaining garnet was taken out by the use of the electro-magnet, the garnet being slightly more magnetic than the barysilite. The remaining willemite, after the heavy solution separation, was so far as possible picked out by hand. The sample, of which 0.3 of a gram was available, was approximately 90% pure as shown by the analysis.

The optical constants were determined by the immersion method, and are as follows:

The mineral is uniaxial negative with $\epsilon \perp$ to the basal cleavage.

	Optical character	ω	ϵ
Barysilite[2]—Pajsberg	Uniaxial negative	$2.07 \pm .01$	$2.05 \pm .01$
Barysilite—Franklin	Uniaxial negative	$2.05 \pm .01$	

The purified sample was analyzed by Mr. Shannon with the following results:

	1. Per cent	2. Mol. Ratio	3. Recal. to 100% after deducting garnet and willemite		4. Mol. Ratio
SiO_2	18.73	.311	16.96	.281	$.281 = 2 \times .140$
Al_2O_3	1.76	.017			
PbO	71.14	.318	80.24	.359	$.398 = 3 \times .133$
FeO	0.24	.003			
CaO	0.10	.002			
MgO	1.02	.025			
MnO	3.97	.056	2.80	.039	
ZnO	1.69	.020			
$H_2O + 105°C$	0.63	.040			
$H_2O - 105°C$	0.10				
Total	99.38		100.00		

Since it was known that garnet and willemite were present in the sample, it was considered that garnet would account for all the alumina and most of the bivalent oxides except ZnO, PbO, and some MnO; willemite was estimated on the basis of the ZnO present. The water was disregarded. It thus appeared that the sample was composed as follows:

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[1] H. E. Vassar. *Am. Mineral.*, **10,** 123 (1925).

[2] E. S. Larsen. *Bull.* **679,** *U. S. Geol. Survey*, p. 44.

	Per cent
Lead silicate	88.66
Garnet	7.69
Willemite	2.29
Water	0.73
	99.37

The lead silicate, recalculated to 100% gave the figures in Column 3 and the molecular ratios as shown in Column 4 correspond reasonably closely to the formula $3(Pb, Mn)O.2SiO_2$ which is that of barysilite.

The mineral is easily fusible to a blackish purple glass. It is slowly decomposed by hot concentrated hydrochloric acid with separation of silica.

PROCEEDINGS OF SOCIETIES

PHILADELPHIA MINERALOGICAL SOCIETY

Academy of Natural Sciences of Philadelphia, March 11, 1925

A stated meeting of the Philadelphia Mineralogical Society, held on the above date, was attended by twenty-seven members and six visitors. Vice-president Arndt presided in the absence of President Vaux.

Mr. Karl Kugler, of Philadelphia, was elected to junior membership.

Announcement was made that in accordance with the amendment to the By-Laws, recently adopted, the society will hereafter meet on the first Thursday of each month, excepting July and August.

The society was addressed by Mr. J. W. Radu, of New York City, on "*The Orientation and Cutting of Gem Minerals*." The geometrical proportions of the perfect "brilliant" cut were first described. In this form the gem has 58 faces, arranged in three principal regions, which are called respectively the table, the girdle, and the culet.

Zonally colored minerals, such as sapphire, emerald, or amethyst, should be cut so that the culet lies in the zone of deepest color. Even if the remainder of the stone is colorless, the whole will then appear colored when viewed from the top. Dichroic minerals should be cut with the axis of the culet perpendicular to the *c*-axis of the crystal.

Synthetic rubies and sapphires usually have their *c*-axis perpendicular to the longest axis of the "boule," as the uncut synthetic crystal is called. The boules are very unstable and shatter very readily when struck. The synthetic rubies are cheaper than the sapphires because their boules usually break into larger pieces, and are therefore more easily cut.

As the second part of his program the speaker gave a demonstration of the fluorescence of many specimens of willemite, pectolite, and other minerals in the ultraviolet light from an iron arc. Phosphorescence was also shown by means of a number of artificial salts. After the meeting adjourned the exhibition was continued informally until a late hour.

Horace R. Blank, *Secretary*

NEWARK MINERALOGICAL SOCIETY

The seventy-eighth meeting of the Newark Mineralogical Society was held on Jan. 3, 1926. President Miller presided, forty-seven members being present.

Mr. Thowless made a motion to have the By-Laws amended so as to conform to the laws of incorporation. This motion was carried. Messrs. Thowless, Carpenter and Broadwell were appointed on the committee to draft the revision.

In response to a letter from Mr. Van Horn the Secretary urged all members to become subscribers to The American Mineralogist. The applications of the eight prospective members that were in the hands of the committee were accepted.

Mr. Bates made a motion that a set of resolutions be spread upon the minutes with reference to the death of Professor Colton. Dr. Colton was the first president of the Newark Society and occupied the chair from the time of the installation, November 17, 1915, until December 4, 1920, when he relinquished the office to retire to his home in Duchess Co., New York.

Mr. J. W. Radu then presented his paper on "*Gem Stones*." Mr. Radu had hundreds of dollars worth of cut and uncut stones on exhibit and gave a very detailed account of the cutting and polishing of gems. Mr. O. Ivan Lee supplemented this talk with a discussion on the chemistry of gem stones.

Wm. H. Broadwell, *Secretary*

The seventy-ninth meeting of the Newark Mineralogical Society was held on February 7, 1926. President Miller presided and thirty members were present. A motion was made that a letter of thanks be sent Dr. Whitlock for the copy of "The Calcites of New York" which was presented to the Society and also for his kindness in being present and explaining special features of the collection to the members upon their recent visit to the American Museum of Natural History.

At the close of the business meeting Mr. Miller presented his paper on "*Notes on Calcites*." Mr. Miller explained the crystal system, Mr. Broadwell the formation and genesis and Mr. Walther spoke on the "Calcites of England." This was followed by brief talks by several other members.

Wm. H. Broadwell, *Secretary*

The eightieth meeting of the Newark Mineralogical Society was held on March 7, 1926. Mr. Thowless presided and eighteen members were present. A letter from the New York Club inviting the members to attend their next meeting and bring for exhibition purposes specimens of the rare earths was read and accepted. A progress report was made on the By-Laws. Three applications for membership were received and accepted.

It was then arranged that a trip to Philadelphia be made on March 21 to view the Vaux collection of minerals at the Academy of Sciences.

Mr. Lee then gave a talk on "*The Rare Earths*," stressing particularly the newest member—hafnium. This was followed by talks from other members, all of whom had exhibits on display.

Wm. H. Broadwell, *Secretary*

NOTES AND NEWS

Koenig Mineral Collection for University

A gift of a valuable collection of minerals to the University of Pennsylvania has been announced by Dr. Frederick Ehrenfeld, Professor of Geology. The collection contains about three thousand specimens and is the gift of George E. Nitzsche. The collection was the property of the late George A. Koenig, who was Professor of Geology and Chemistry at the University for many years. The minerals were gradually acquired by Dr. Koenig from 1875 to 1910; and in 1923 the collection became the property of Mr. Nitzsche, who has just presented them to the University, together with a fund for their perpetual care and for adding specimens to it from time to time. The collection has been installed in the Geological Museum of the University and will be known as "The George A. Koenig Memorial Collection."

This was a significant gift, since the University, for many years, was pre-eminent in America for its Geological Department and Dr. Koenig was a contemporary and friend of John A. Rider, Edward Drinker Cope, Joseph Leidy and many other naturalists who were connected with the University of Pennsylvania. Dr. Koenig also assisted in completing some of the great mineral collections in America, among them that of the late Clarence Bement, whose valuable collection, only within recent years, was sold to the New York Museum of Natural History.

With its many other special collections, the University now possesses one of the largest and most important collections of minerals in the United States. It has, however, always been cramped for space, and has never been able to display adequately, even some of the rarer specimens. If properly housed, the University's present Geological collections could easily fill a spacious Geological Museum building.

Mrs. Elsie Koenig Nitzsche has also presented the University with a bronze memorial tablet in honor of her father.—*The Pennsylvania Gazette*

Professor B. S. Hopkins of the University of Illinois has recently isolated the hitherto unknown element No. 61. Four hundred pounds of monazite residues yielded the element after repeated fractional crystallizations. The discovery is based on new lines found in the spectrum, bands in the absorption spectrum and lines in the x-ray spectrum. The new element has been named *illinium* with the chemical symbol Il. At the present time all but two of the ninety-two elements have been discovered. The missing elements are numbers 85 and 87.

A copy of Bulletin 31 of the United States National Museum publications dealing with The Minerals of Idaho, by Earl V. Shannon, has just been received. This volume of 480 pages and 19 plates contains a description of approximately 230 minerals found in Idaho. It is a comprehensive work on regional mineralogy and will be welcomed by all American mineralogists. A limited number of copies are available for free distribution by the Museum and may be had upon request by any interested party. After the exhaustion of the free quota a few additional copies will be sold at 75 each by the Superintendent of Documents, Government Printing Office, Washington, D. C.

On September 21-22 of this year the Mineralogical Society (London) will celebrate its Jubilee. On those days there will be held in London a "reception and conversazione" and a dinner. Visits will also be arranged to mineral collections, museums, etc. After the celebration in London, and possibly also in the preceding week, excursions will be conducted to mineral localities in Cornwall, Devon and to the north of England. A cordial invitation is extended to the members of the Mineralogical Society of America to attend this celebration.

The Russian government announces that the geological committee of the Supreme Economic Council formed 215 scientific expeditions in 1925. These expeditions reported rich lead deposits in the trans-Baikal region, gold fields in the Aldan region of Siberia and important coal strata on Sakhalin Island. These explorations will be continued during 1926, the government having set aside $1,500,000 for this purpose.

CORRECTION

CORRECTION TO ARTICLE, "DUMORTIERITE FROM NEVADA" APRIL, 1926, P. 95

The refractive index of alpha was determined from an obtuse bisectrix figure exhibiting the dispersion $\rho < \nu$. The wording of this part of the article gives the erroneous impression that the dispersion of the optic axes of the acute bisectrix as ordinarily stated is $\rho < \nu$. Wright and Allen have presented a means of expressing this dispersion of the acute bixectrix so that any possible misunderstanding will be avoided. Following their formula the dispersion of the dumortierite should read $2V_r > 2V_\nu$. Much better material is now being obtained than any available at the time the above article was written.

ERNEST E. FAIRBANKS

NEW MINERALS: NEW SPECIES

CLASS: OXIDES

Bromellite

G. AMINOFF: Ueber Berylliumoxid als Mineral und dessen Krystallstruktur. (Beryllium oxide as a mineral and its crystal structure). *Zeit. Krys.*, **62**, 113–22 (1925).

NAME: In honor of the early Swedish mineralogist, Magnus von *Bromell.*

CHEMICAL PROPERTIES: An oxide of beryllium. Formula: BeO. Analysis: BeO 98.02, CaO 1.03, BaO 0.55, MgO 0.07, MnO tr., Sb_2O_5 0.29, Al_2O_3 0.14, ign. 0.85; sum 100.68. Insoluble in acids.

CRYSTALLOGRAPHIC PROPERTIES: Hexagonal, dihexagonal pyramidal class. Combination of prism and base, rarely with pyramid. $a : c = 1 : 1.6288$. $p_0 = 1.8808$. $c : p = 62°00'$. $c = 4.36$ Å, $a = 2.68$ Å. Lattice similar to zincite.

PHYSICAL AND OPTICAL PROPERTIES: Color white. Uniaxial, positive. $\epsilon = 1.733$, $\omega = 1.719$. Cleavage prismatic, distinct. $H = 9$. Sp. gr. 3.017. Pyroelectric.

OCCURRENCE: Found at Långban associated with Swedenborgite. This is probably the unknown white mineral mentioned in the description of swedenborgite.

DISCUSSION: The natural mineral is very similar to the artificial BeO. Aminoff points out the great similarity of bromellite to zincite. It is interesting to note the analogous occurrence of bromellite at Långban with zincite at Franklin.

W. F. FOSHAG

DOUBTFUL SPECIES

CLASS: COLUMBATES, ETC.

"Pisekite"

August Krejci: Pisekite, a new radioactive mineral or pseudomorph. *Casopis Min. Geol. Prague*, **1**, 2–5 (1923). Also Bohuslav Jezek: *Ibid.*, pp. 69–70.

Name: From the locality, *Pisek*, Bohemia.

Chemical Composition: A columbate and titanate of uranium and the rare earths. Qualitative analysis showed Cb, Ta, Ti, U, rare earths, and traces of Sn; also Si, Al, K, Ca, Mg as admixtures.

Crystallographic Properties: Prismatic with forms like monazite.

Physical and Optical Properties: Color yellowish to black. Isotropic. Strongly radioactive. Hd. 5.5–6. Sp. gr. = 4.032.

Occurrence: Found in the beryl bearing pegmatites at Pisek, Bohemia.

Discussion: X-ray data showed this mineral to be amorphous. Further data is necessary to define this mineral. W. F. F.

CLASS: VANADATES, ETC.

"Kolovratite"

V. F. Vernadsky: *Compt. Rend. Acad. Sci. Russia*, p. 37, (1922). Also P. N. Chirvinsky: *Min. Mag.*, **20**, 290 (1925).

Name: In honor of L. S. *Kolovrat*, a Russian radiologist.

Chemical Composition: Believed to be a vanadate of nickel.

Physical Properties: Color yellow to greenish yellow.

Occurrence: Found as thin botryoidal crusts on siliceous and calcareous slates at Fergana, Russian Turkestan. W. F. F.

CLASS: SILICOTITANATES.

Ramsayite

E. Kostyleva: Sur une nouvelle espece mineral—la ramsayite dans les Montes Chibines et Lujawsart en Laponic russe. (A new mineral—ramsayite from Mts. Chibines and Lujawsart, Russian Finland). *Compt. Rend. de l'Acad. d. Sci. d. Russ.*, 55-58 (1923).

Name: In honor of the Finnish mineralogist, *W. Ramsay*.

Chemical Properties: A silico-titanate of sodium. Formula: $Na_2O.\ 2SiO_2.\ 2TiO_2$. Analysis (K. F. Beloglasov): SiO_2 34.06, TiO_2 46.26, Al_2O_3 0.90, Fe_2O_3 1.03, MnO 0.02, CaO 0.33, MgO tr, K_2O 0.28, Na_2O 16.20, rare earths 0.32, ign. 0.33; sum 99.75. Insoluble in acids except hydrofluoric acid. B.B. fuses easily.

Crystallographic Properties: Orthorhombic. Forms: (111), (221), (322), (100), (110). $a:b:c = 1.2116:1:1.6520$.

Physical and Optical Properties: Color, dark brown to black. Translucent in thin splinters. Luster metallic. Cleavage (100) good, (110) less so. Biaxial negative. $2E = 49.9$. Index of refraction greater than 1.83. $X = a$, $Y = b$, $Z = c$. Dispersion strong.

Pleochroism strong; X and Y, light orange; Z, light yellow. Sp. Gr. 3.43.

Occurrence: Occurs abundantly in many of the nepheline syenite pegmatites in Mts. Chibines and Lujawsart, Russian Finland, in crystals up to 5 cm in length.

DISCUSSION: This mineral is undoubtedly the same as lorenzenite. The lorenzenite is described as having the composition $Na_2O. 2SiO_2. 2TiO_2$ with some of the titarium replaced by zirconium. Only $\frac{1}{4}$ of the titanium is replaced so that there is no essential difference between that mineral and the ramsayite. W. F. F.

CLASS: SILICATES

"Befanamite"

A. LACROIX: MINERALOGIE DE MADAGASCAR. Vol. **3**, 311, (1923). Also Vol. **1**, pp. 500–502.

NAME: From the locality, *Befanamo*, Madagascar.

CHEMICAL COMPOSITION: A silicate of scandium. Formula: $Sc_2Si_2O_7$. Analysis (Mean of 5) SiO_2 44.1, ZrO_2 8.4, Sc_2O_3 42.4, Al_2O_3 3.3, Fe_2O_3 2.0; sum 100.2. Unattacked by acids.

CRYSTALLOGRAPHIC PROPERTIES: Orthorhombic. $a : b : c = 0.7456 : 1 : 1.14912$.

PHYSICAL AND OPTICAL PROPERTIES: Color grayish green; $n = 1.803$; birefringence 0.05. $2V = 50°$. $\rho < \nu$, Hd. 6–7. Sp. Gr. 3.492. Brittle.

OCCURRENCE: Found in the region of Befanamo to the east of d'Ankazobe, Madagascar, associated with beryl, strüverite, monazite and probably fergusonite. Crystals were found up to 10 cm. in length.

DISCUSSION: Lacroix separates the mineral from Befanamo from thortveitite on the basis of the absence of yttrium and the high content of Zr and Al. These differences are not essential and the name befanamite should be synonymous with thortveitite. W. F. F.

"Hagatalite"

KENJIRO KIMURA: The Chemical Investigations of Japanese Minerals containing the rare elements. Part V. *Jap. Jour. Chem.*, **2**, 82–84 (1925).

NAME: From the locality, *Hagata*, Iyo Province, Japan.

CHEMICAL PROPERTIES: A silicate of zirconium and rare earths. Analysis: MgO 0.2, CaO 0.3, Fe_2O_3 2.3, Al_2O_3 2.8, rare earths 13.1, UO_2 tr., ThO_2 1.5, ZrO_2 42.0, SiO_2 29.7, $(Nb, Ta)_2O_5$ 2.7, ign. loss 5.5; sum 100.1.

CRYSTALLOGRAPHICAL PROPERTIES: Crystals with forms and angles like zircon.

PHYSICAL PROPERTIES: Color yellowish gray, brownish gray or gray. Streak dark to light gray. Hd. 7.5. Sp. Gr. 4.4. Brittle.

OCCURRENCE: Found as small crystals 1–5 mm. in diameter in biotite in the pegmatites of Hagata, Iyo Province, Japan.

DISCUSSION: Described as a variety of zircon. It differs from most of the cyrtolites in its higher content of tantalum and columbium. W. F. F.

"Oyamalite"

Ibid. pp. 84–85.

NAME: From the locality, *Oyama*, Iyo Province, Japan.

CHEMICAL PROPERTIES: A silicate of zirconium and rare earths. Analysis: MgO 0.8, CaO 0.6, Fe_2O_3 0.6, Al_2O_3 2.0, rare earths 17.7, ThO_2 0.6, ZrO_2 40.9, SiO_2 25.7, P_2O_5 7.6, ign. loss 3.5; sum 100.0.

PHYSICAL PROPERTIES: Color dark green or brown; streak yellowish white to white. Hd. 7.5, Sp. Gr. 4.1.

OCCURRENCE: Found as radial aggregates in feldspar in a pegmatite at Oyama, Iyo Province, Japan.

Discussion: Described as a variety of zircon differing from most cyrtolites in its high content of phosphorus. The possibility of an admixture of xenotime has not been entirely excluded. W. F. F.

A. N. Winchell: Studies in the Feldspar Group. *Jour. Geol.*, **33**, 714 (1925).

The feldspar group is further subdivided and the following names proposed: Analbite = anorthoclase with less than 10% of $KAlSi_3O_8$; albiclase = Ab 10–20; andeclase = Ab 30–40; labratownite = Ab 60–70 and bytownorthite = Ab 80–90. W. F. F.

CLASS: ORGANIC COMPOUNDS

"Hoelite"

Ivar Oftedal: Result. Norske Stats. Spitsbergenekspeditioner. Kristinia. Vol. **1**, 9–14 (1922).

Name: In honor of Adolph *Hoel*, Norwegian geologist.

Chemical Composition: Anthraquinone, $C_{14}H_8O_2$.

Crystallographic Properties: Needles.

Physical and Optical Properties: $n = 1.75$, birefringence 0.3. Sp. Gr. 1.43

Occurrence: Found as a sublimate from burning coal. W. F. F.

DISCREDITED SPECIES

Chalcopyrrhotite

Per Geijer: *Geol. Fören. Förh. Stockholm*, **46**, 354 (1924).

A re-examination of Blomstrand's original specimens demonstrates that chalcopyrrhotite is identical with cubanite. W. F. F.

REDEFINITION OF SPECIES

CLASS: SULFIDE. DIVISION: R : S = 2 : 1.

Jalpaite

Georg Kalb and Maximilane Bendig: Erzmikroskopiche Untersuchung der Mineralreihe Silberglanz-Kupferglanz. (Chalcographic Examination of the mineral Series Argentite-Chalcocite.) *Centr. Min. Geol.*, p. 516 (**1924**).

An analysis of jalpaite from Schlangenberg, Altai, gave Ag 71.73, Cu 14.10, S 16.33, corresponding closely to the analysis of the mineral from Jalpa, Mexico, and the theoretical composition $3Ag_2S.Cu_2S$. Cleavage pseudo-octahedral. Between crossed nicols anisotropic. Apparently distinct from argentite with a composition of $3Ag_2S.Cu_2S$. W. F. F.